



A proper size measure for quorum sensing ignition

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A Proper Size Measure for Quorum Sensing Ignition

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Abstract:

Biofilm aggregates of bacteria are thought to be able to align their phenotypic behavior with size, density, and growth state of the ensemble. This is achieved by a cell-cell regulatory system termed quorum sensing. In the generic quorum sensor a positive feedback in the production of signal molecules defines the conditions at which the collective behavior switches on. In spite of its conceptual simplicity, a proper measure of biofilm colony "size" has been lacking. We establish that the cell density multiplied by a geometric factor constitutes an appropriate size measure. The geometric factor is the square of the radius for a spherical colony. For a disk-shaped biofilm the geometric factor is the horizontal dimension multiplied by the height, and the square of the height of the biofilm if there is significant flow above the biofilm. Remarkably simple factorized expressions for the size are presented. *Mol. Biosyst.*, 2014, 10, 103-9

:

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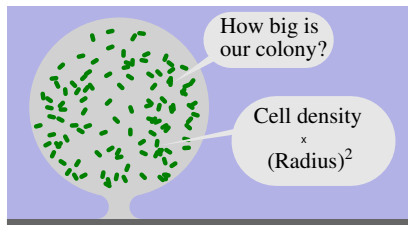
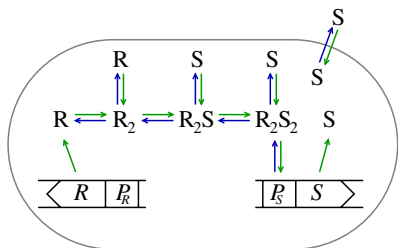
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A proper size measure for Quorum Sensing Ignition

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Ferkinghoff-Borg & Sams
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doi: 10.1021/bi400315s

QS reaction-diffusion model

1. Cells produce signal molecules, S, at rate $[b_s; k_s]$.
2. Signal molecules diffuse between cells.
3. Cells produce regulator protein, R.
4. Regulators bind signal molecules (K).
5. SR complex promotes S production (K_s).
6. Signal-Regulator complex induces attack.

Take home

Size Measure:

$$\Sigma = \rho_v \mathcal{R}^2$$

Ignition point:

$$r_a = [R_2S_2] \sim \frac{b_s}{k_s} K_s$$

